



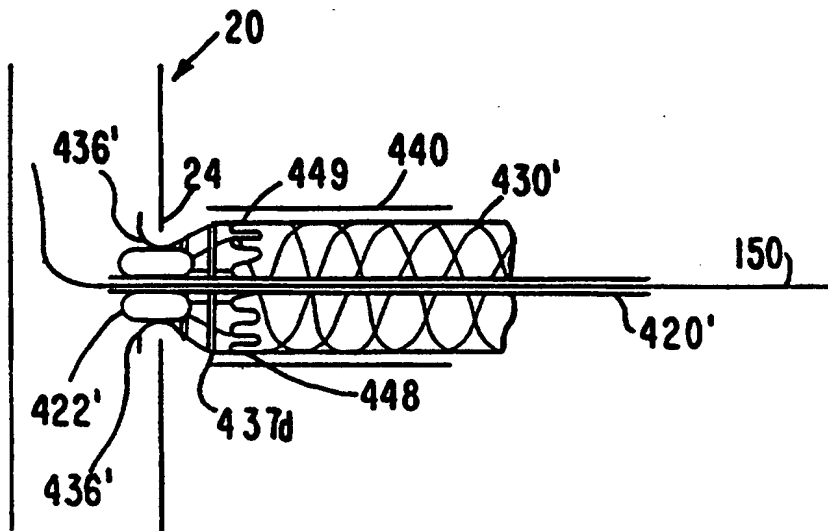
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(54) Title: MEDICAL GRAFTING CONNECTORS AND FASTENERS

(57) Abstract

A body tissue graft for use in a patient includes a frame structure made of a first elastic material, a covering of a second elastic material on the frame structure, the covering substantially filling openings in the frame structure, and a connector connected to the frame structure. Projections are secured to the connector structure. The projections facilitate attachment of the tubular graft in a patient by securing the graft to the body tissue with which the graft is employed. The connector selectively circumferentially expands and the projections selectively circumferentially expand. This may be done using an inflatable balloon to circumferentially expand the projections. A restraining member may be provided to restrain the projections in a cone shape so that an end of the graft may be used to open an aperture through a side wall of existing body organ tubing and a portion of the projections may enter the aperture.



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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 97/19946

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A61F2/06 A61B17/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61F A61B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 96 22745 A (SCHNEIDER USA INC ;INDIANA UNIVERSITY FOUNDATION (US); UNIV JOHNS) 1 August 1996	1-13, 19-21, 23,24, 27,28, 31,32, 34-36, 46-49, 58-61
A	see the whole document --- -/--	16,51, 62,130

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- *Z* document member of the same patent family

Date of the actual completion of the international search

23 July 1998

Date of mailing of the international search report

4 August 1998 (04.08.98)

Name and mailing address of the ISA

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 712 614 A (ADVANCED CARDIOVASCULAR SYSTEM) 22 May 1996 see the whole document ---	1-6, 8-13, 19-21, 28,29, 31-37, 58-61
X	WO 93 00868 A (OWEN EARL RONALD) 21 January 1993 see the whole document	58-60, 63-65
A	---	1-3,8,9, 15
X	GB 2 269 104 A (LAZIM TAHA ROUDAN ;LAZIM TAHA ROUDAN (MY)) 2 February 1994 see page 5, paragraph 3 - page 7; figures	58
A	---	1,4,20, 23,24, 27,28, 59,126
X	WO 96 14808 A (ADVANCED CARDIOVASCULAR SYSTEM) 23 May 1996 see abstract; figures see page 8, line 7 - page 11, line 23	66-71, 74-78, 84, 93-98, 101-105, 111
A	---	80,81, 107,108, 130-132, 141
X	WO 89 08433 A (LAZARUS HARRISON M) 21 September 1989 see page 8, line 4 - line 24; figures	66-69, 77, 92-96, 104,119
X	EP 0 701 800 A (BARD INC C R) 20 March 1996 see figures	66,68, 69,93, 95,96
A	---	70-72, 97-100
X	WO 96 25897 A (MENLO CARE INC) 29 August 1996 see page 9, line 2 - line 5; figures	120-125
7 X	WO 93 20757 A (BAXTER INT) 28 October 1993 see page 9, line 15 - page 11, line 16; figures	120-125
2	---	-/--

INTERNATIONAL SEARCH REPORT

Intern 1st Application No
PCT/US 97/19946

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 94 01056 A (BOSTON SCIENT CORP) 20 January 1994 see page 13, line 16 - line 24; claim 2; figure 2 ---	120-125
X	GB 489 316 A (DAVIS & GECK, INC) 25 July 1938 see figures 4,5,7A ---	120-125
A	---	126
A	WO 95 14442 A (UNIV JOHNS HOPKINS) 1 June 1995 see figures 1,2 ---	126
A	WO 95 21592 A (MINTEC INC ;GOICOECHEA GEORGE (BS); HUDSON JOHN (US); MIALHE CLAUD) 17 August 1995 see page 15, line 3 - line 11; figures -----	130-132

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 97/19946

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 127-129
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-57,58-65

A graft having a frame structure with a covering and a connector fixed to the frame structure on both ends.

2. Claims: 66-119

A connector to be inserted inside into a graft and which is enlargeable to press the graft into body tissue.

3. Claims: 120-125

A graft having two spaced annular flange portions.

4. Claim : 126

An artificial graft having a first tubular portion and a second tubular portion which is transverse and in fluid communication with the first tubular portion.

5. Claims: 130-142

An apparatus to extend a graft having struts on its outer ends in a cone-shaped arrangement.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 97/19946

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9622745 A	01-08-1996	US 5591226 A US 5755775 A	07-01-1997 26-05-1998
EP 0712614 A	22-05-1996	AU 3783195 A CA 2162956 A JP 8336597 A	23-05-1996 16-05-1996 24-12-1996
WO 9300868 A	21-01-1993	AU 658915 B CA 2112474 A EP 0593600 A JP 7500023 T US 5456714 A	04-05-1995 21-01-1993 27-04-1994 05-01-1995 10-10-1995
GB 2269104 A	02-02-1994	NONE	
WO 9614808 A	23-05-1996	EP 0790810 A US 5769887 A	27-08-1997 23-06-1998
WO 8908433 A	21-09-1989	US 5104399 A AT 137655 T AU 637318 B AU 3439289 A AU 663583 B AU 3826193 A AU 693294 B AU 4088696 A CA 1335528 A DE 68926452 D DE 68926452 T EP 0407425 A EP 0688544 A JP 3503246 T US 5397345 A US 5662700 A US 5693083 A US 5669936 A US 5562728 A US 5275622 A US 5749920 A	14-04-1992 15-05-1996 27-05-1993 05-10-1989 12-10-1995 01-07-1993 25-06-1998 04-04-1996 16-05-1995 13-06-1996 12-09-1996 16-01-1991 27-12-1995 25-07-1991 14-03-1995 02-09-1997 02-12-1997 23-09-1997 08-10-1996 04-01-1994 12-05-1998

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 97/19946

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0701800 A	20-03-1996	AU 3056395 A JP 8299456 A	28-03-1996 19-11-1996
WO 9625897 A	29-08-1996	AU 4929696 A CA 2213403 A EP 0810845 A US 5674241 A	11-09-1996 29-08-1996 10-12-1997 07-10-1997
WO 9320757 A	28-10-1993	CA 2118395 A EP 0637224 A JP 7505803 T US 5609626 A	28-10-1993 08-02-1995 29-06-1995 11-03-1997
WO 9401056 A	20-01-1994	US 5366504 A EP 0651624 A JP 7509152 T US 5674276 A	22-11-1994 10-05-1995 12-10-1995 07-10-1997
GB 489316 A		NONE	
WO 9514442 A	01-06-1995	US 5443497 A AU 1256095 A EP 0730436 A JP 9511409 T	22-08-1995 13-06-1995 11-09-1996 18-11-1997
WO 9521592 A	17-08-1995	US 5609627 A AU 693527 B AU 1870995 A AU 6381598 A AU 6381698 A CA 2182982 A DE 29521548 U EP 0759729 A EP 0782841 A EP 0783873 A EP 0783874 A JP 9511160 T US 5716365 A US 5693086 A US 5776180 A	11-03-1997 02-07-1998 29-08-1995 18-06-1998 18-06-1998 17-08-1995 10-07-1997 05-03-1997 09-07-1997 16-07-1997 16-07-1997 11-11-1997 10-02-1998 02-12-1997 07-07-1998

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